



Amended Claims to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A manipulandum device adapted to allow interaction between a user and a computer, the device, ~~An apparatus,~~ comprising:
  - a housing;
  - a sensor configured to detect a movement of at least a portion of the housing, the sensor configured to output sensor signals associated with the movement; and
  - an electroactive polymer actuator coupled to the housing and configured to output a haptic-feedback force associated with the output sensor signals.
2. (Previously presented) The device of claim 1, wherein the haptic-feedback force is associated with an event implemented by a host computer.
3. (Previously presented) The device of claim 1, wherein the haptic-feedback force output by the electroactive polymer actuator is an inertial force caused by moving a mass.
4. (Withdrawn) The device of claim 1, further comprising a button, the haptic-feedback force being output through the button.
5. (Withdrawn) The device of claim 4, wherein the button is configured to respond to the haptic-feedback force in a degree of freedom of motion of the button.

6. (Withdrawn) The device of claim 4, wherein the button is configured to respond to the haptic-feedback force with a lateral movement, approximately perpendicular to a degree of freedom of motion of the button.
7. (Withdrawn) The device of claim 1, wherein the haptic-feedback force output by the electroactive polymer actuator is a rotary force.
8. (Withdrawn) The device of claim 1, wherein the haptic-feedback force output by the electroactive polymer actuator is a linear force.
9. (Previously presented) The device of claim 1, wherein the electroactive polymer actuator is configured to move portions of the housing.
10. (Withdrawn) The device of claim 1, wherein the electroactive polymer actuator is configured to modify the frictional resistance of a moving part.
11. (Withdrawn) The device of claim 1, wherein the electroactive polymer actuator is configured to output the haptic-feedback force to a rotating wheel coupled to the housing.
12. (Withdrawn) The device of claim 8, wherein the electroactive polymer actuator is configured to move a portion of a member from inside of the housing to outside of the housing.

13. (Withdrawn) The device of claim 12, wherein the electroactive polymer actuator is one of a plurality of electroactive polymer actuators, the plurality of electroactive polymer actuators being arranged in a tactile array.

14. (Withdrawn) The device of claim 1, wherein the housing is configured as a stylus.

15. (Withdrawn) The device of claim 1, wherein the housing is configured as a trackpoint joystick controller.

16. (Currently Amended) A manipulandum device adapted to allow interaction between a user and a computer, the device, ~~An apparatus,~~ comprising:

a sensor configured to detect a movement of at least a portion of the apparatus, the sensor configured to output sensor signals associated with the movement; and

an electroactive polymer actuator coupled to the apparatus and configured to output a haptic-feedback force associated with the output sensor signals, the electroactive polymer actuator being controlled by associated input signals.

17. (Previously presented) The device of claim 16, wherein the haptic-feedback force output by the electroactive polymer actuator is an inertial force caused by moving a mass.

18. (Withdrawn) The device of claim 16, further comprising a button, the haptic-feedback force being output through the button.

19. (Withdrawn) The device of claim 16, wherein the haptic-feedback force output by the electroactive polymer actuator is a rotary force.
20. (Withdrawn) The device of claim 16, wherein the haptic-feedback force output by the electroactive polymer actuator is a linear force.
21. (Withdrawn) The device of claim 16, wherein the electroactive polymer actuator includes at least two layers of electroactive polymer material, the electroactive polymer actuator being configured to bend based on a characteristic of each layer of electroactive polymer material.
22. (Withdrawn) The device of claim 16, wherein the electroactive polymer actuator includes a dielectric surrounded by two electrodes, the dielectric being configured to expand in area when activated by the input signals.
23. (Previously presented) The device of claim 16, wherein the electroactive polymer actuator is configured to move portions of the apparatus.
24. (Withdrawn) The device of claim 16, wherein the electroactive polymer actuator is configured to modify the frictional resistance of a moving part.

25. (Withdrawn) The device of claim 16, wherein the electroactive polymer actuator is configured to move a portion of a member from inside of the apparatus to outside of the apparatus.

26. (Currently Amended) A manipulandum device adapted to allow interaction between a user and a computer, the device, ~~An apparatus,~~ comprising:

a housing; and

an electroactive polymer (EAP) element coupled to the housing and configured to output a haptic-feedback force associated with output sensor signals, the EAP element being controlled by associated input signals, the haptic-feedback force being generated by deformation of the EAP element.

27. (Withdrawn) The device of claim 26, wherein the EAP element is configured to detect a contact of the housing.

28. (Withdrawn) The device of claim 26, wherein the EAP element is configured to detect the magnitude of an applied pressure on the EAP element.

29. (Withdrawn) The device of claim 26, wherein the haptic-feedback force output by the EAP element is a linear force.

30. (Withdrawn) The device of claim 26, wherein the housing is configured as a joystick or a trackpoint controller.

31. (Currently Amended) A method of providing haptic feedback to a user interacting with a computer using a manipulandum device, comprising:

detecting movement of a housing of a manipulandum and outputting sensor signals associated with the detected movement; and

outputting a haptic-feedback force, the haptic-feedback force being generated by a deformation of an electroactive polymer actuator, the haptic-feedback force being based on input signals to the electroactive polymer actuator.

32. (Withdrawn) The method of claim 31, wherein the electroactive polymer actuator is configured to output a rotary force.

33. (Withdrawn) The method of claim 31, wherein the electroactive polymer actuator is configured to output a linear force.

34. (Withdrawn) The method of claim 31, wherein the electroactive polymer actuator is configured to modify the frictional resistance of a moving part.

35. (Previously presented) The method of claim 31, wherein the electroactive polymer actuator is configured to move portions of the housing.

36. (Withdrawn) An apparatus, comprising:  
a substantially planar member having an electroactive polymer and a compliant member, the substantially planar member defining a plane, the electroactive polymer being configured to

receive a signal and to deform in at least one of a direction substantially corresponding to the plane and a direction substantially normal to the plane, in response to the signal to output a haptic feedback.

37. (Withdrawn) The apparatus of claim 36, wherein:

the compliant member is a first compliant member, the substantially planar member further including a second compliant member, the electroactive polymer being disposed between the first compliant member and the second compliant member.

38. (Withdrawn) The apparatus of 36, wherein:

the compliant member is a first electrode, the substantially planar member further including a second electrode, the electroactive polymer being disposed between the first electrode and the second electrode,

the electroactive polymer having a width between the first electrode and the second electrode, the electroactive polymer being configured to deform in response to the signal so that the width of the electroactive polymer is modified.

39. (Withdrawn) An apparatus, comprising:

an electroactive polymer; and

an electrode coupled to the electroactive polymer, the electrode configured to receive a signal associated with a haptic feedback force,

the electroactive polymer configured to deform in response to the signal to output the haptic feedback force.

40. (Withdrawn) The apparatus of claim 39, wherein:

the electroactive polymer and the electrode are collectively cantilevered to a base and defining a direction substantially perpendicular to the base, the electroactive polymer configured to deform with respect to the direction.

41. (Withdrawn) The apparatus of claim 39, the electrode being a first electrode, further comprising:

a second electrode, the electroactive polymer being disposed between the first electrode and the second electrode,

the first electrode, the second electrode and the electroactive polymer being collectively cantilevered to a base and collectively defining a plane, the electroactive polymer configured to deform with respect to at least one of along the plane and substantially perpendicular to the plane.

42. (Withdrawn) The apparatus of claim 39, the electrode being a first electrode, further comprising:

a second electrode and a third electrode,

the electroactive polymer forms a cylindrical structure, the first electrode, the second electrode and the third electrode being disposed in contact with the electroactive polymer, the electroactive polymer being configured to deform in two degrees of freedom.



43. (Withdrawn) The apparatus of claim 39, the electrode being a first electrode, further comprising:

a second electrode, the electroactive polymer being disposed between the first electrode and the second electrode,

the first electrode, the second electrode and the electroactive polymer collectively defining a plane, the electroactive polymer configured to deform with respect to at least one of along the plane and substantially perpendicular to the plane.

44. (Withdrawn) The apparatus of claim 39, the electroactive polymer being a first electroactive polymer and the electrode being a first electrode, further comprising:

a second electroactive polymer, the first electroactive polymer and the second electroactive polymer being collectively coiled into a cylindrical structure having a first end and a second end; and

a second electrode, the first electrode and the second electrode being disposed at a first end and a second end of the cylindrical structure,

the first electrode, the second electrode, the first electroactive polymer and the second electroactive polymer collectively defining a direction, the electroactive polymer configured to deform substantially along the direction.

45. (Currently Amended) A manipulandum device adapted to allow interaction between a user and a computer, the device, An apparatus, comprising:

means for detecting movement of a housing and outputting sensor signals associated with the detected movement; and

means for outputting a haptic-feedback force, the haptic-feedback force being generated by a deformation of an electroactive polymer actuator means, the haptic-feedback force being based on input signals to the electroactive polymer actuator means.

46. (Withdrawn) The apparatus of claim 45, wherein the electroactive polymer actuator means is configured to output a rotary force.

47. (Withdrawn) The apparatus of claim 45, wherein the electroactive polymer actuator means is configured to output a linear force.

48. (Withdrawn) The apparatus of claim 45, wherein the electroactive polymer actuator means is configured to modify the frictional resistance of a moving part.

49. (Previously presented) The method of claim 45, wherein the electroactive polymer actuator means is configured to move portions of the housing.